THEME	Revolutionize Aviation
LEVEL I	Vehicle Systems
LEVEL II	Aerospace Propulsion and Power
Level III	**Higher Operating Temperature Propulsion Components - HOTPC**

OBJECTIVE

The objective of the HOTPC Project is to conduct research that leads to the development of multidisciplinary technologies for affordable propulsion engine components that will enable the system to operate with reduced cooling while sustaining performance and durability. The technical approaches being pursued include: extending the temperature capability of all classes of materials throughout the entire engine, developing life prediction methodologies for the resulting materials and components, validating material characterization behavior and component structural performance with data from rig and engine tests, and replacing standard, metallic, propulsion components with lighter weight advanced materials.

KEY DELIVERABLES

1	Coatings for Commercial Subsonic Engine Applications	10/02
2	Lightweight Advanced Engine Component	10/03
3	Technology Transfer Conference	6/05

IMPACT

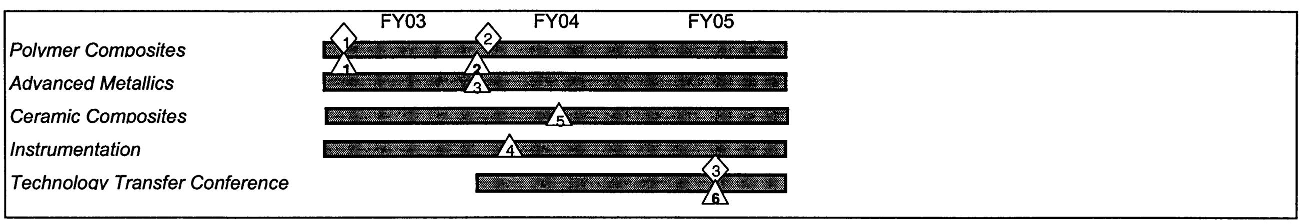
In order to maintain the position of the United States as a world leader in the production of commercial aircraft into the next century, vast improvements in the performance of jet engines must be made. This will require the use of highly advanced aerodynamic concepts, which in turn demand advanced material systems capable of withstanding extremely high temperatures and operating loads. In recognition of this national need for advanced materials, the HOTPC Project was initiated in FY00. The Project emphasizes the enabling materials and structures technologies as well as high temperature instrumentation for all classes of subsonic engines.

TECHNICAL APPROACH

The technical approaches being pursued include: extending the temperature capability of all classes of materials throughout the entire engine, developing life prediction methodologies for the resulting materials and components, validating material characterization behavior and component structural performance with data from rig and engine tests, and replacing standard, metallic, space propulsion components with lighter weight advanced materials. Several Project tasks are devoted to extending the temperature capability of SOA (State- Of-the-Art) materials. To meet this objective, new polymer chemistries are being investigated as resin systems for the composites which, by design, will have higher glass transition temperatures resulting in a material system that can endure a higher operating temperature environment. A second approach to accomplish this objective is to develop coatings which can be applied to SOA material systems to enable higher temperature operability and/or a longer design life. Coatings, currently being developed in the Project, will protect the substrate structural material from erosion and oxidation which occur in the hot section of the engine.

In another set of tasks, several analytical tools and models are under development that will computationally predict the behavior and performance life of advanced material systems. Another tool enables an engineer to computationally design an alloy with tailored properties for a specific application. All of these tools will help accelerate the development and application of advanced material systems. Of course, analytical tools do not provide all of the insights and answers. Furthermore, industry practices as well as material and component design codes are based on a myriad of data; therefore, another portion of the Project is devoted to understanding the physics of advanced materials and the structural behavior responses: fatigue behavior, joining methods, processing techniques, manufacturing technology, and foreign object damage tolerance.

SCHEDULE



MILESTONES

1	**L2 - Engine test a coated PMC inlet guide vane (Level II, '03 GPRA)**	**10/02**
2	**L2 - Engine test PMC component (alt. wording for 03 Perf. Pln revision: Complete demonstration of PMC component in realistic engine environment.)**	**9/03**
3	L3 - Develop Fatigue Life Model for Turbine Components Based on Flaw Population	9/03
4	L3 - Demonstrate Ceramic Strain Gage at 1300 C	1/04
5	L3 - Test Internally Cooled Silicon Nitride Vanes	5/04
6	**L2 - Conduct HOTPC Technology Transfer Conference Summarizing 5yrs of Technology Development**	**6/05**

MANAGEMENT

HOTPC is a Level III project at the Glenn Research Center. Level I Manager is Richard Wlezien at HQ. Level II Manager is Gary Seng at the Glenn Research Center. Level III Manager is Carol Ginty at the Glenn Research Center. This project is in full compliance with NPG7120.5B.

RESOURCES

	FY03	FY04	FY05
Funding (M$)	5.808	4.725	4.725
Workforce (WY)	30.0	23.0	23.0

KEY FACILITIES

	FY03	FY04	FY05			
Materials Testing Labs						
Analytical Sciences Lab						
Fatigue and Structures Lab						
Burner Rig Test Facility						

AGREEMENTS

Partner	Agreement Title	Number
AADC/Rolls Royce	Erosion Coatings Development and Testing	NAS3-98003
Boeing Rocketdyne	High Temperature PMC Development and RBCC Engine Test	NAS3-99135
Pratt & Whitney	Erosion Coatings for High Temperature Polymer Matrix Composites in Turbine Engines	NAS3-98005
Kulite Semiconductor Products	SiC Pressure Sensor Package Development	NAS3-99099
GE Aircraft Engines	ME3 Alloy Fatigue Testing	SAA3-260
AFRL	Impact Resistance Testing of Nb-Si and Mo-Si Samples	SAA3-307
ASM	Material Data Management Consortium	SAA3-514
Ladish	Dual Microstructure Heat Transfer Treatment Technology for Disks	SAA3-522

ACQUISITION STRATEGY

Due to the broad nature of the HOTPC Project, a variety of acquisition instruments will be employed. Procurements will be in accordance with approved procedures at the procuring Centers. Free and open competitive procurements will be used to the maximum extent possible. Among the approaches to procurement, the most likely include NASA Research Announcements (NRA's), NASA Cooperative Agreement Notices (CAN's), and Requests for Proposals (RFP's). These vehicles will result in grants, cooperative agreements and contracts. For any onsite contractors, performance based contracts are the preferred instrument.

RISK MANAGEMENT

Risk	Mitigation Strategy
Insufficient funding in FY's 04 and 05	Communicate needs and impacts to the Program Manager; Develop a detailed Descope plan
If PMC's cannot withstand the thermal and mechanical loads associated with access to space, then component weight may not be reduced.	1. Conduct thermal and mechanical tests on PMC coupon specimens. 2. Select an alternate access to space component in a less demanding environment.

TECHNOLOGY TRANSFER

An objective of the HOTPC Project is to ensure rapid and effective dissemination of the technology to U.S. industry. Technology transfer mechanisms depend on the maturity of the technology. A variety of technology transfer mechanisms will be employed. The most important mechanisms are direct involvement by the customers in the formulation of the project described in this plan, direct contract of R&D and cooperative agreements with industry and other government agencies. The HOTPC Project will fund R&D contracts, SAA's, PBC's, and grants to ensure direct transfer of technology to the U. S. industry; increasing the likelihood of transfer into customer products. Technology exchange also occurs when Project personnel participate in special technical working group meetings. Presentations at technical conferences sponsored by the AIAA, SAMPE, ASTM, and other similar professional societies will be limited to discussion of non-competitive sensitive information.

EDUCATION OUTREACH

See Level II Plan

SIGNATURES

9/26/02

Gary Seng
Level II Manager

9/26/02

Carol Ginty
Level III Manager